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The invention relates to an apparatus for the run cleaning of workpieces such as wires, fibers, strands or belts, the one wash penetrated with an ultrasonic field and/or rinsing liquid go through in accordance with the features in the preamble of Claim 1.

On the surface of wire or fiber oxide formation as well as other bringing in can lead to damages at the Ziehwerk. Before pulling the workpieces of pull-better, oils or greases go through u.dgl. For the subsequent treatment therefore such contaminants must become remote.

By stranding, lichens or bundles of thin wires or fibers to strand or fiber cord the gussets between the single wires or fibers form elongated cavities with very much small diameter, for so called capillaries. In principle the formation of capillaries has capillarity to the sequence. Such strand or fiber cord sucks itself with moistening liquid full like a sponge.

With the production of strand or fiber cord by stranding or bundles from wires or fibers the fine cavities with different bringing in become and/or. Contaminants such as Ziehfett, oil, oxide, dirt u.dgl. clogged. For certain uses of the strand or fiber cord, for example in the medical technology such contaminants are harmful and must remote become. Furthermore the contaminants know Umspritzen with polytetrafluoroethylene (trade name by evaporation with the heat treatment to damages at the annealing furnaces as well as during the subsequent treatment of the strand or fiber cord by hot encasing with plastic, for example: Teflons or Hostalfon) to committee lead. High temperatures arise with which the contaminants mentioned melt or evaporate. That leads partial eliminated to discolorations, bubble formation or to the destruction of the shroud by alkaline-aqueous or sour-aqueous cleaning baths can these contaminants become. In the cavities of the strand or fiber cord however no sufficient rinse occurs. In addition the cleaning bath is already in such a manner contaminated after short time with the residues of the contaminants that alone the residues of the contaminated bath lead to the same damages as the contaminants themselves. These drawbacks could so far only by the treatment of the strand with fluoridated or chlorinated hydrocarbons (FCKW and/or. CKW) avoided become. This method is health and environmentalharmful and therefore to avoids.

Known solid metal wires with ultrasound are to be cleaned. The electric vibrations generated of high frequency generators become radiated by ultrasonic oscillators into mechanical vibrations same frequency converted and into a cleaning medium. From the very rapid change of course and pressure phase countless small vacuum bubbles result at the surface of the cleaning-good. These so called cavitation vesicles implode in the pressure phase and blow thereby contaminants off at the surface of the cleaning-good. With a known apparatus ultrasonic oscillators with wide radiate-flat become used, which are into a pickling bath immersed. By the wide radiate-flat the ultrasonic energy standing for the order becomes radiated over a large area on the pickling liquid. That leads to the fact that the middle power density is small in the pickling liquid, expressed in watts per cubic centimeters or liter relative and decreases by attenuation with the removal from the ultrasonic oscillator. In order to increase the power density, one changed over therefore in addition, several ultrasonic oscillators concentric to each other to arrange for example six ultrasonic oscillators to an ultrasonic tubing oscillator with hexagon cross section so that a concentration of the power density becomes achieved. In the focal plane a power density becomes achieved thereby which is sufficient to the cleaning of solid wires. This apparatus working in the pickling liquid requires principle-conditional relative high technical and machine Aufwand. Dadurch that the practical entire plant the ultrasonic fields is direct or exposed indirect by reflection, arises a wear as a result of cavitation at all surfaces of the ultrasonic producers. This lack must become by an expensive construction of the plant balanced, z. B. by intensified wall thickness or improves materials. Furthermore by the dipping oscillator principle the maintenance of the plant is pedantic and time-consuming, since always first bath contents must become emptied. Furthermore it is known to use for the cleaning of wires a cylindrical washing chamber which becomes energized of several arranged annular ultrasonic producers coaxial at the outside circumference, which the ultrasonic energy transfers to the wash and/or rinsing liquid. By this formation the source of ultrasonic relative from the subject-matter which can be cleaned remote is far, so that high absorption losses in the liquid in addition, in the wall of the ultrasonic chamber arise.

The power densities rich attainable with the foregoing described apparatuses however not out, in order to clean for example strand. For this subsequent is entered still more in greater detail.

On the basis of this state of the art, the invention the object is the basis to indicate an apparatus with which an ultrasonic field of high energy can become concentrated in close proximity of the subject-matter generated which can be cleaned.

The solution of the object exists in the measures listed in the characterizing part of the claim 1. Developments of the invention are in the Unteransprüchen described.

With the apparatus can become solid wires, fibers or differently formed contaminated workpieces such as belts or

boards cleaned. The ultrasonic chamber of the form of the cleaning-good is to be only adapted. With separated parts a transporting device is to the difference to continuous parts such as being planned wires, passed with which the parts at the source of ultrasonic become along by the ultrasonic chamber. The apparatus according to claim 1 is suitable particularly favourably for cleaning Metallize or fiber cord (glass fiber strand), since also can become achieved in the cavities a metallic pure surface. Here the invention the finding is the basis that a satisfactory result can be only attained formed strand to the cleaning of capillaries or fiber cord of last end, if the strand or fiber cord energy becomes as many supplied that the narrow capillary federation caused by stranding or bundles is briefly loosened up, so that wash or rinsing liquid can flow through the strand or fiber cord transverse to the longitudinal direction. From this then derived according to invention are, the source of ultrasonic, a concentrated ultrasonic field the generated to arrange in close proximity of the subject-matter which can be cleaned. The practical undamped ultrasonic field is in the layer to produce both cavitation in the capillaries to shift and the strand or fiber cord in vibrations. It made thus an intensive cleaning and flushing by an interaction of cavitation and vibration.

With the apparatus no complete are in the wash or rinsing liquid immersed ultrasonic oscillators present. The apparatus used instead an ultrasonic chamber, which is flowed through on the inside with wash or rinsing liquid. In the simplest case it can act around a pipe section out of metal, which in the center of the cross section the strand or fiber cord travels through, and which is at the ends up to a passage opening sealed. As rinsing liquid tap water can become used. The concentrated ultrasonic field becomes reflected, so that no shadowing made, at the walls of the ultrasonic chamber. D. h. the subject-matter which can be cleaned becomes cleaned of all sides in a pass. The cleaning of bind or plate shaped cleaning-good becomes that cleaning-good for example with the return turned.

The ultrasonic oscillator is arranged outside of the ultrasonic chamber radial to the ultrasonic chamber and dips with the bottom end of the sonotrode by an opening into the ultrasonic chamber (claim 2 and 4). With the formation according to invention of the apparatus no splashing required is, all components is free accessible and can maintained or exchanged in a simple manner become. The technical effort is conceivable simple. Because the ultrasonic oscillator dives in only with a part of its sonotrode into the rinsing liquid, which reminders lie such as transducers and amplitude transformer in the free one is a wear to a large extent only on the sonotrode limited, which leads to a reduction of the operating and repair costs. For the rinsing liquid running off only a receptacle needs to become provided, so that the rinsing liquid running off can become reused (claim 8).

As expiration for the rinsing liquid from the ultrasonic chamber according to claim 5 can become the circumferential gap in the ultrasonic chamber used, serving for the decoupling of ultrasonic oscillator and ultrasonic chamber. The claims 6 and 7 contain a spraying protection for the rinsing liquid.

There is commercial ultrasonic oscillators for the ultrasonic welding of plastics or metals known. These ultrasonic oscillators possess an elongated sonotrode of small width, so that the ultrasonic energy can become concentrated on the weld. It turned out that these ultrasonic oscillators excellent for the application according to invention are suitable. By the elongated form of the sonotrode they can be adapted the particularly simple elongated form of the ultrasonic chamber. On the one hand thereby the width of the ultrasonic chamber small can be held, on the other hand the generated ultrasonic field a prolonged effective distance along the strand concentrates (claim 9). The power density of the sound field can according to claim 10 be increased and/or. the effective sound field increase.

Subsequent one is on the basis the drawing an embodiment of the invention more near explained.

It shows

Fig. 1 the front view of the apparatus,

Fig. 2 a section by the apparatus along the line of A-B in Fig. 1,

Fig. 3 a section by the apparatus along the line CD in Fig. 1,

Fig. 4 in the enlarged yardstick represented inlet and outlet end of the ultrasonic chamber.

In the figs of the drawing illustrated apparatus is for cleaning continuous continuous strand 5 designed and essentially consists of by an high frequency generator fed ultrasonic oscillator 6 and an ultrasonic chamber 8 arranged over a catchment basin 7. Of course the apparatus according to invention is suitable also for cleaning solid wires or single fibers, for example glass fiber.

With the ultrasonic oscillator 6 it acts around a commercial embodiment like it for the ultrasonic welding used becomes. The ultrasonic oscillator 6 has a rod-shaped form and consists of a converter 9 with the terminal 10 for not the represented high frequency generator and one at the opposite end arranged flat elongated sonotrode 11 from metal. Between the converter 9 and the sonotrode 11 is the amplitude transformer 12.

The function and impact of the ultrasonic oscillator 6 are well known; without a closer description can be done therefore. It is only mentioned ones that with the help of the converter 9 the electric vibrations of the high frequency generator become into mechanical vibrations converted and with the sonotrode 11 radiated. During a generator achievement of 1500 watts the sonotrode with a frequency of 20 kHz swings. By immersion of the sonotrode 11 into a rinsing liquid the vibrations become into the rinsing liquid radiated. In the embodiment tap water becomes used as rinsing liquid. Of course also another rinsing medium can become, for example an basic-aqueous or sour-aqueous rinsing liquid used.

The ultrasonic chamber 8 consists of a piece of metal tube of approx. 500 millimeters length and a diameter of approx. 50 millimeters. Both ends are 13 sealed with a plug, which exhibits a central passage opening 14 for the strand 5. As from Fig. 2 of the drawing to infer is, goes through the strand 5 the ultrasonic chamber in longitudinal direction. With the foregoing listed data and dimensions can be treated wires or strands up to 10 millimeters diameters. With band shaped cleaning-good the passage opening is 14 the volume cross section adapted. At the outside circumference of the ultrasonic chamber 8 a coupling sleeve is 15 mounted for the rinse water inlet. The ultrasonic chamber is flowed through in the operation complete with rinsing liquid. At the outside circumference of the ultrasonic chamber 8 is furthermore a slit 16 for the passage of the sonotrode 11. As from Fig. 1 comes out, is

the slit 16 in the middle of the ultrasonic chamber 8. Around the slit 16 around a sheet metal screen is 17 18 fixed with orifices. As from Fig. 3, are not the ultrasonic chamber 8 horizontal over the catchment basin 7 on a not more near referred cross beam stored and the ultrasonic oscillator 9 vertical with its converter housing 9 to a not represented console fixed come out. The sonotrode 11 seizes by the slit 16 of the ultrasonic chamber 8 through and dives with the free end into the ultrasonic chamber 8 with the rinsing liquid. As from Fig. 3, dives in the sonotrode 11 to close comes out to the passage opening 14 of the ultrasonic chamber 8. Between the slit 16 and the sonotrode 11 is a circumferential gap 19, which serves a direct contact of the two parts 8, 11 prevented and as rinse water expiration. By the drain ports 18 of the shield 17 the rinsing water can run off and becomes in the catchment basin 7 collected. Between the rinse water inlet and the catchment basin 7 a not represented pump connected can become, so that a closed rinse water cycle develops. The apparatus for the run cleaning of wires od.dgl. it differs from the apparatus for pieces of individual work by the fact that a transport device for the unique pieces must become provided.